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TECHNOLOGICAL INNOVATION IN BRAZIL:AN EVALUATION OF REGULATORY FRAMEWORK ADVANCEMENTS

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ABSTRACT

The present paper addresses the impact of government on the technological innovation process in Brazil and assesses the impacts of a new regulatory framework for innovation, characterized by the enactment of the Innovation Act and the so-called Good Act, on the two other players of the national technological innovation system: academia (universities and scientific institutions) and the corporate sphere (businesses and trade associations). In fact, the contributions – and responsibilities – of government are not always understood by stakeholders in the technological innovation process. Therefore, we begin by presenting the history and evolution of main points in the Brazilian legal framework for technological innovation, its recent events and challenges, as well as relevant advancements in the regulation and fostering of science and technology in the country. We also present the results of a field study conducted through structured interviews of representatives of each of the three players (government–academia–corporate sphere), who reported their perceptions of benefits and restrictions brought about by the recent regulatory advancements, as well as suggesting improvements. Our conclusions suggest that, recent progress notwithstanding, integration between the three aforementioned players must be intensified if Brazil is to improve its position in international rankings and leave the sidelines of technological innovation.

Keywords: Innovation, Government, Legislation, Companies, Universities.

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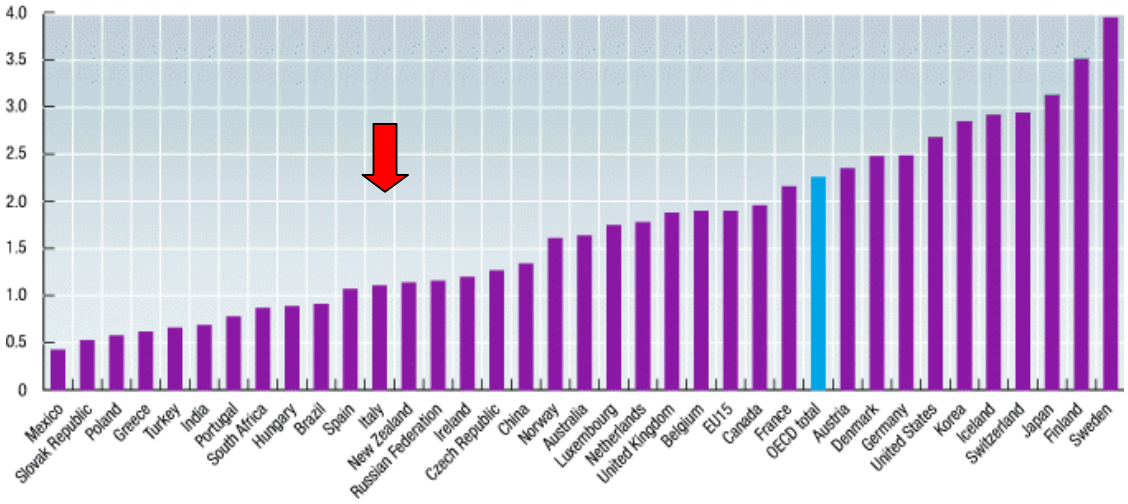
1. INTRODUCTION

The *Oslo Manual* defines technological innovation as "implemented technologically new products and processes and significant technological improvements in products and processes" (OECD and Eurostat, 2005). Technological innovation has been identified by several authors worldwide as the driving force behind the so-called New Economy. Accordingly, several studies have compared countries' innovative performance, such as a recent OECD (2007) study that ranked developed and developing nations according to domestic expenditure on research and development (R&D) as a percentage of gross domestic product (GDP).

Brazil features prominently in this ranking (Graph 1), especially when one considers it is led only by developed countries, except for China; the Asian giant is the exception in nearly all performance indicators due to its significant growth over the past ten years. Brazil's position in the OECD ranking means the country invests nearly 1% of its GDP on research and development. Comparatively, the average R&D expenditure of OECD member states, all of which are developed nations, is 2.25% (lighter column in Graph 1).

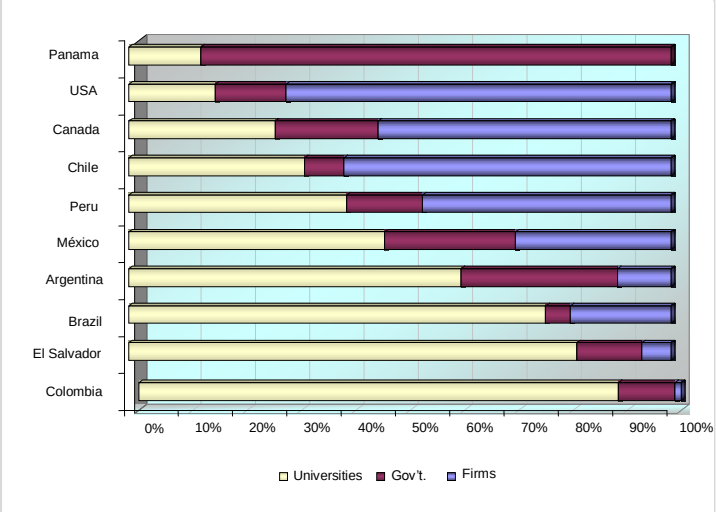
Graph 1: ***Gross domestic expenditure on R&D as a percentage of GDP, 2005 or latest available year***



Source: OECD (2007).

On the other hand, when one analyzes the distribution of researchers across institutional sectors (Graph 2), it becomes clear that researchers do not make the transitions from universities to the corporate world. Alongside other indicators, this shows that interaction between these two agents of the national innovation system is weak, which places the country in a rather paradoxical situation. Brazil has a fair number of scientific researchers, backed by a reasonable or good scientific infrastructure, but these researchers are disconnected from the corporate world and, consequently, from technological innovation.

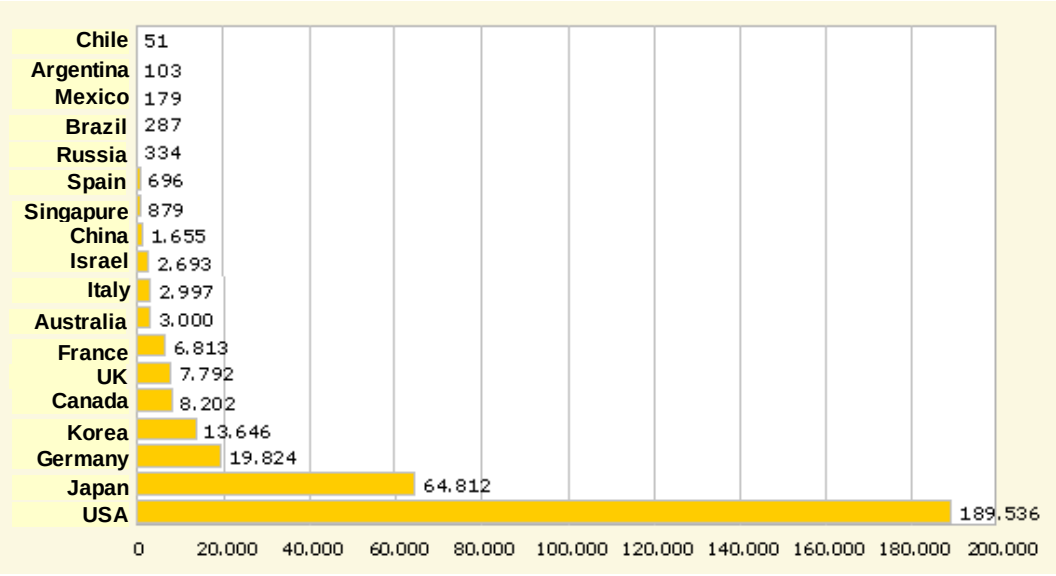
Graph 2: ***Researcher distribution across institutional sectors (2004)***



Source: Indicadores de Ciencia y Tecnologia, RICYT, 2004.

A similar situation is found when patent requests filed at the USPTO are analyzed (Graph 3). Once again, Brazil lags far behind developed countries in number of patent requests, but, on the other hand, has a comfortable lead over other South American countries. From this information, one may conclude that much knowledge is created in the country, but little of it is turned into technology.

Graph 3: ***Patent requests filed at the U.S. Patent and Trademark Office (2004), broken down by country***



Source: Brazilian Ministry of Science and Technology (2004).

A common feature of comparative analyzes such as the OECD study mentioned is the question of how federal governments perform in promoting and regulating innovation. The Constitution of

Brazil, through Articles 218 and 219, emphasizes the role of the government as a promoter of science and technology (Brazil, 1988):

> *Article 218. The State shall promote and foster scientific development, research and technological expertise.*[5]
>
> *Article 219. The domestic market is part of the national patrimony and shall be supported with a view to permitting cultural and socio-economic development, the well-being of the population and the technological autonomy of the country, as set forth in federal law.)*[6]

The *Oslo Manual* – a key reference work in the technological innovation field, providing guidelines for data collection and interpretation – maintains that the role of government extends beyond that of promoting and regulating innovation into its execution and funding, and states: "The government is a major player in R&D execution and funding, mainly owing to a low level of resources devoted to R&D by businesses" (OECD, 2005:156). Besides government, particularly at the federal and state level, the *Manual* notes two other fundamental actors of technological innovation: a) firms and trade associations; and b) universities and scientific institutions. These three players constitute the pillars of innovation: government, firms, and academia.

The contributions and responsibilities of the federal government to technological innovation processes in Brazil are sometimes poorly understood by stakeholders. The time has come for a study of technological innovation that focuses on how the government promotes, regulates, and fosters it, in order to clarify the role of governments in the innovative process. Previous studies have shown that "[legal] instruments are scattered throughout the structure of the Brazilian government, making their identification in each case exceedingly complex, particularly when one considers the separation of public power into three spheres. The statutory basis for the provision of funding and incentives in Brazil is scattered over a myriad of instruments and has yet to be properly systematized." (Sbragia, Andreassi, Campanário and Stal, 2006).

The international context and the dynamics of the Brazilian legal framework lead to a need to understand the various instruments provided by several public entities. This paper therefore seeks to discuss the role of the government in the technological innovation process in Brazil, with a particular focus on the impact of the Innovation Act and the so-called "Good Act" (Chapter III) – two recent statutory advances in the governmental promotion and regulation of science and technology in the country.

Our methods were initially based on an observed reality: the finding by Sbragia, Andreassi, Campanário and Stal (2006) that a full understanding of the role played by the government in innovation is still lacking, as the institutionalization of a regulatory framework for science and technology in Brazil has only recently advanced. Bearing this problem in mind, we chose to highlight the history and evolution of the role of the government in innovation and of the new legislation underpinning recent advances in the regulatory framework of science and technology in Brazil. We then proceeded to collect secondary data on perceptions of the Innovation Act and Good Act and their impacts, by interviewing representatives of the three stakeholders most involved in

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[5] Paragraphs 1 through 5 of Article 218 were omitted for clarity.

[6] English text of the Constitution adapted from *Brazil: Constitution, 1998 with 1996 reforms, Title VIII.* Retrieved March 5, 5008, from Georgetown University, Center for Latin American Studies, Political Database of the Americas website: http://pdba.georgetown.edu/Constitutions/Brazil/brtitle8.html.

innovation: the government, the corporate sphere, and academia. We chose the Ministry of Science and Technology's General Coordinator for Technology Services to represent the government. To represent universities and scientific institutions, we chose Inova, the State University of Campinas Innovation Agency, and, to represent companies, the State of São Paulo Industry Federation (FIESP) Department of Competitiveness and Technology and the National Association for R, D&E of Innovative Companies (ANPEI), a trade group representing innovative Brazilian companies. By combining the perceptions of these three players, one may analyze advances made in the innovation framework. Finally, through our conclusions, we seek to contribute to a better performing of these players' respective roles, and highlight the need for integration among them.

2. THE REGULATORY FRAMEWORK IN BRAZIL: HISTORY AND EVOLUTION

2.1. Government actions during the past two administrations

Analysis of federal government actions during the past two administrations – that is, from 1999 to 2002 (second term of Fernando Henrique Cardoso) and from 2003 to 2006 (first term of Luiz Inácio Lula da Silva) – shows that both administrations played a key role in promoting, regulating, and funding science and technology in Brazil, as summarized below. Highlights of the second Cardoso administration (1999–2002), as enumerated in a government publication known as the *Livro Branco* (Brazil, 2002), include:

- institutionalization of the Industrial Survey of Technological Innovation (*Pesquisa Industrial sobre Inovação Tecnológica*, Pintec), commissioned by the Ministry of Science and Technology to the Brazilian Institute of Geography and Statistics (IBGE);
- realization of several editions of the National Conference for Science, Technology and Innovation, an important forum for discussion and science and technology policy management;
- publication of the *Livro Branco* ("White Book"), outlining a long-term policy or "[a] consensus agenda to provide direction", initially scheduled to take place from 2002 through 2012;
- consolidation of the role of the MCT as "the agent responsible for formulating science and technology policy and, in conjunction with its funding agencies, regulatory bodies, companies, and research institutes, a executor and provider of funding for activities seeking the country's social and economic development";
- actions toward broadening the Ministry's scope of activity and rationalizing its structure, notably:

  – amalgamation of the Brazilian Space Agency (AEB) and the National Nuclear Energy Commission (CNEN);

  – creation of the Center for Strategic Studies and Management (CGEE);

  – structural reform of the CNPq and Finep;

  – launching of new instruments to foster innovation, such as Inovar, Progex, and the Finep Award for Technological Innovation;

  – making the activities of the National Fund for Scientific and Technological Development (FNDCT) permanent;

  – strengthening of research and innovation funding through the establishment of 14 *Fundos Setoriais* (sector-specific funds);

– drafting of the New Innovation Act;

– designation of 2002 as the Year of Innovation;

– establishment of a ten-year goal for innovation funding: investing no less than 2% of GDP toward R&D activities by 2012, considering an annual GDP growth of 4%.

In 2007, five years after implementation of these measures, their importance to the creation of a renewed science-technology infrastructure in Brazil is clear. Brazil is still far from reaching its goal of investing 2% of GDP towards research and development within ten years of implementing the above measures (that is, in 2012).

One highlight of the first administration of President Luiz Inácio Lula da Silva (2003–2006), as noted in the *Relatório de Gestão do MCT* ("MCT Management Report") (Brazil, 2007) was greater closeness in relations between the Executive and Congress, leading to the creation of the *Frente Plurissetorial em Defesa da Ciência e Tecnologia*,[7] which contributed decisively to the enactment of several bills and *Medidas Provisórias*[8] that broke new ground for science in Brazil, namely:

- The *Lei de Inovação* (Innovation Act, Law nº 10.973 of 12 December 2004) (Brazil, 2007e): fosters research and development of novel processes and products in private enterprise, through integration of efforts made by universities, research institutions, and technology-based companies. Such integration used to be quite difficult due to the lack of statutory regulation. The Act also provides incentives so that companies may hire researchers more often;
- *Lei de Informática* (Information Technology Act, Law nº. 11.077 of 30 December 2004): a sweeping fiscal reform passed by the Congress of Brazil in 2004 included provisions to extend tax benefits for the IT sector until 2019, bringing an advantage to R&D investment in IT companies. The September 2006 decree that brought the Act into force provides that companies entitled up to a 95% exemption from the IPI (*Imposto sobre Produtos Industrializados*, a federal tax levied on manufactured products) must invest an amount equivalent to 5% of domestic earnings after tax obtained from sale or manufacturing of IT products subject to the Act's benefits. The Act also regulates the payment of prior R&D debts and elaborates on the exclusivity of Brazilian companies taking part in restricted federal biddings for IT purchases;
- *Lei do Bem* ("Good Act", Law nº. 11.196 of 21 November 2005) (Brazil, 2007f): encourages innovation in private companies by, among other measures, providing a 50% IPI exemption on imported equipment purchased for R&D activities;
- *Lei de Biossegurança* (Biosafety Law, Law nº. 11.105 of 24 March 2005): regulated the establishment and operation of the National Biosafety Council (*Conselho Nacional de Biossegurança*), making way for broad scientific and technological research in this key field, including embryonic stem cell research, which was previously illegal in Brazil;
- *Lei de Regulamentação do FNDCT* (Law Regulating the National Fund for Scientific and Technological Development, Law nº. 8.172 of 18 January 1991): the Law establishes that the FNDCT – the main instrument for scientific research funding in Brazil – will be run by a board

[7] A Congressional member organization, also including representatives from academia and business, dedicated to pursuing the advancement of science and technology. *Frentes Parlamentares*, which do not include members of the public, are analogous to U.S. Congressional caucuses.

[8] A *Medida Provisória*, or Provisional Measure, is a presidential decree, having force of law, which is enacted without legislative intervention and later submitted to Congress for appreciation, becoming a law if approved or losing its force otherwise. Provisional Measures are meant to address pressing legal needs, when waiting for legislative approval or consideration would be impractical.

of directors and follow a schedule to release blocked funding; the scientific community had long pushed for both advances. The bill was submitted to Congress in late 2006.

- *Lei do MEC* (Ministry of Education and Culture Law, Law nº 11.487 of 15 June 2007): regulates corporate funding of research projects conducted by scientific and technological institutions (*Instituições Científicas e Tecnológicas*, ICTs). The *MEC Law* amended Law nº 11.196 of 21 November 2005 to provide for new incentives to technological innovation and change federal rules for accelerated cost recovery of R&D investments.

The Industrial, Technological and Foreign Trade Policy (*Política Industrial, Tecnológica e de Comércio Exterior*, PITCE) was launched by the Lula administration in 2004. A simple and straightforward document, it features a conceptual characterization of industrial policy, its basic characteristics, programs and activities. According to Toni (2006), the PITCE provides guidance to increase the innovative capacity of companies, particularly those in export-geared production chains and industrial sectors. Its main points are:

(1) fostering competitiveness with a view to foreign markets and maintaining trade surplus;

(2) selective targeting of technology-intensive production chains and industrial sectors;

(3) providing specific industrial sectors with a combination of tax incentives, regulatory measures, provisions to ensure the security of contracts, and business environment improvements;

(4) contributing to regional development.

2.2. Recent regulatory framework for Technological Innovation

According to Toni (2006), some studies classify the evolution of technological innovation into three periods:

- *Operational:* surfaced in the 1950s, relating company characteristics to those of its industrial sector, as a result of the permanent search for solutions for R&D problems. In this paradigm, technological innovation is viewed as a linear process, almost solely derived from scientific discovery (that is, invention). Innovation is still exogenous companies do nothing more than improve upon adaptive, passive forms.

- *Structure-behavior-performance*: focuses mostly on the storehouse of capabilities a company should have so that it may be successful in its technological strategy, rather than the dynamic capabilities required to provide support for this strategy. Studies now show that innovation does not originate solely on the shop floor, but may also come from more complex environments as a result of interactions between manufacturers, suppliers, and users or customers.

- *Resource-based*: Characterized by a combination of technological resources seeking maximization of the innovative process. Business strategy and innovation strategy are no longer considered separately, and technological innovation is considered the company's main asset in most cases. A company's competitiveness is based on its capacity to mobilize resources to create information and turn these resources into knowledge, which is applied to new products and processes with market value.

According to a ANPEI (2006) study, the first legal instruments directed at fostering innovation in Brazil were implemented in 1993 through Law nº. 8661, which, among other measures, provided for the income tax deduction of R&D expenses, IPI exemption on equipment purchased for R&D activities, and the possibility of accelerated depreciation for such equipment. In order to qualify for

benefits, companies had to submit a development agenda known as a "Program for the Development of Industrial Technology" (PDTI) (or in the agribusiness sector, a "Program for the Development of Agriculture Technology", PDTA) to the Ministry of Science and Technology for previous evaluation. Companies whose programs were approved became eligible for the tax benefits provided by Law nº 8661.

Data from MCT (2006) report show that, to date, only 127 companies have taken part in the tax incentive programs provided for in Law 8661/93 – a practically negligible number when one considers how many businesses operate in Brazil. According to ANPEI (2006), these incentives indeed had little effect, particularly after a series of tax restrictions implemented in 1997 compounded the difficulty companies had already been facing to qualify for and benefit from incentives.

In 2002, tax benefits provided for in income tax legislation were broadened by Law nº. 10.637, which allowed businesses to deduct technological research- and innovation development-related expenses from net profits. Between 1999 and 2002, further measures would be implemented, including the creation of sector funds, new funding instruments such as *subvenção econômica* (a particular type of government grant), interest equalization, and mechanisms to provide liquidity to investments made in sci-tech funds. According to ANPEI (2006), the impact of these instruments decreased markedly during the brief period since they came into effect. Furthermore, they have been somewhat "isolated" in the greater picture of economic policy and due to the absence of broader strategies for industrial development.

In 2004, the Luiz Inácio Lula da Silva administration launched the Industrial, Technological and Foreign Trade Policy, which encompasses 57 measures divided into 11 distinct policy programs (Sbragia *et al*., 2006). Its shortcomings notwithstanding, this proposed change in government policy for industry and technology may be considered an advance on the institutional level and in the broader context of innovation-fostering policy (Gomes *et al*., 2006). Two key instruments enacted as part of this policy – the Innovation Act and Law 11.196/06, informally known as the "Good Act" or "Good Bill" – will be discussed below.

In short, the current regulatory framework seeks to create an environment conducive to corporate involvement in technological innovation processes by fostering tripartite partnerships in order to optimize the use of knowledge accumulated by scientific and technological institutions and existing infrastructure. It also ensures researchers' rights to revenues obtained from developed technology and provides government researchers the opportunity to take leave from their positions and start their own businesses, as long as their activities are innovation-related (Filho, 2005).

2.3. Innovation Act (Law 10.973/2004)

The Innovation Act is considered a cornerstone of the Industrial, Technological and Foreign Trade Policy (PITCE), which has, as its main objective, to increase the economic efficiency and boost development and diffusion of technologies with greater potential for inducing increased activity and improved competitiveness in international trade (Brazil, 2003).

Law 10.973, known as the "Innovation Act", was sanctioned on 2 December 2004 and enacted on 11 October 2005 through Decree 5.563 (Brazil, 2007c) in order to foster cooperation between universities and companies and create technological innovation capable of boosting national competitiveness. The Act is organized into three pillars: 1. Creating an environment conducive to strategic partnerships between universities, technological institutions, and companies; 2.

Encouraging the involvement of scientific and technological institutions in the innovation process; 3. Fostering in-house innovation.

The Act reflects the country's need for effective legal instruments that contribute to building a scenario conducive to scientific and technological development and to fostering innovation. A comparative analysis of the Act shows it was inspired by the French Law on innovation and research (Law n°. 99-587 of 12 July 1999), which set a framework for public-private partnerships and implemented mechanisms to foster technological innovation at the university level. According to Kruglianskas and Matias-Pereira (2005), "The similarity between the content of France's Law on innovation and research and and that of the national [Brazilian] bill is quite evident".[9] Part of the Innovation Act was also inspired by the Bayh-Dole Act (Patent and Trademarks Amendment Act), which gave U.S. non-profit organizations and universities the choice to retain title in inventions made possible by federal funding (Sbragia *et al*., 2006).

The regulatory framework that provides for *subvenção econômica*, a particular case of grant funding, is codified in the Innovation Act and in Law 11.196/05, which will be discussed in detail in the next section. FINEP (*Financiadora de Estudos e Projetos*), an agency of the Ministry of Science and Technology, is in charge of operationalizing grants and funding provision.

2.4. Good Act, Chapter III (Law 11.196/2005)

Over the past ten years, the state of R&D incentives in Brazil has changed, and varied, markedly. This instability was also due to the limitations of the Brazilian taxation system and shows that R&D and innovation support mechanisms in the country are highly inconstant. Up until 2005, legislation meant to foster corporate R&D activities was based on Law nº 8.661/93, which codified, as we have mentioned, the PDTI and PDTA (CNI, 2005).

The past few years have seen the introduction of several new tax incentive programs and the amendment of existing ones, mostly seeking to make them more generous and more specifically directed at certain classes of beneficiaries, such as small and medium enterprises or certain industrial sectors. At the time of writing, 18 OECD member countries had legislation providing for R&D tax incentives, up from 12 in 1996. Special tax treatment afforded R&D spending includes immediate deduction of current R&D expenditure (available in all countries) and several types of tax reductions, such as tax credits (available in 12 countries in 2004) or reduction in taxable income (six countries). Although many existing incentive programs reward incremental increases in R&D spending (with benefits calculated through a variety of formulae), newer incentives are based on current-year R&D investment. In 2004, Spain, Mexico, and Portugal implemented major subsidies for small enterprises and major corporations alike. Canada, the Netherlands, and, particularly, Italy are significantly more generous in providing benefits to small businesses than to larger companies. Austria, Finland, Germany, and the Netherlands also structured and consolidated their innovation support programs in order to make their use simpler and friendlier (OECD, 2005).

Law nº. 11.196 of 21 November 2005, known until its Congressional approval as the *MP do Bem* (the "Good Provisional Measure"; Provisional Measures 252/2005 and 255/2005) and thereafter as the "Good Act", was implemented by Decree nº. 5.798 of 7 June 2006. Articles 17 through 26 of the Act's third chapter consolidate a set of automatic tax incentives for companies that conduct

[9] "A similitude entre o teor da Lei de Inovação e Pesquisa da França e o texto do projeto de lei nacional é bastante evidente" (Kruglianskas e Matias-Pereira, 2005:10).

technological innovation activities. Chapter III of the Good Act was provided for in the Innovation Act.

Benefits provided for in Chapter III of the Good Act are tax incentive-based, namely: income tax deduction of R&D expenses, even on payments made to research institutions, universities, or independent inventors; reduction of IPI levied on equipment purchased to conduct R&D activity; accelerated depreciation equipment purchased to conduct R&D activity; accelerated cost recovery for intangible asset purchases meant to support R&D activity; credits for recovering international withholding tax levied on money sent abroad to pay royalties on technical or scientific support or R&D services; and the elimination of withholding tax on overseas payments made to register or maintain trademarks and patents or to cover the costs of protecting cultivars. Also, payments made to microenterprises and small businesses in exchange for R&D services may be deducted as operating expenses for corporate income tax and CSLL[10] purposes, as long as the services were requested by the payer rather than offered by the small business; such payments are also deductable for the provider.

As well as tax incentives, the federal government also provides subsidies for companies that hire graduate-level researchers to conduct technological R,D&I activities as defined by MCT Directive nº. 557. The monetary value of these incentives and subsidies increased considerably as compared to those provided for in previous legislation, allowing a relevant reduction in the cost of corporate R,D&I projects.

The Good Act defines technological innovation as the conception of a new product or manufacturing process, as well as the addition of new functionalities or characteristics to an existing product or process, as long as this addition constitutes incremental improvement leading to improved quality or productivity and, consequently, greater competitiveness. Simple modernization expenses, such as the acquisition of new industrial equipment or new technology, are therefore not eligible for the Act's benefits (Weisz, 2006).

In June 2006, the Good Act was amended by Law 11.487, known as the "MEC Law" (short for Ministry of Education and Culture), which expanded benefits for corporate projects carried out in partnership with scientific and technological institutions (ICTs). This change made it possible for companies to deduct 50% to 250% of investment made on research, technology, and innovation projects carried out by ICTs for tax purposes (specifically, for CSLL calculation).

3. ANALYSIS OF THE RESULTS AND IMPACT OF THE NEW LEGAL FRAMEWORK

3.1. Innovation Act (Law 10.973/2004)

After the Innovation Act was signed into law, the government began reformulating all R&D-fostering legislation. First, because of the consequent expansion in subsidizing and funding cost equalization mechanisms, which now receive resources from the National Fund for Scientific and Technological Development (FNDCT); second, because the federal government consolidated its tax incentive proposals into Provisional Measure 255/05, which was approved in October 2005, creating a specific chapter for technological innovation (CNI, 2005).

[10] The *Contribuição Social sobre o Lucro Líquido* (CSLL) is a corporate tax meant to provide funding for Social Security.

The Act provides a highly relevant mechanism to foster the innovation process in public research institutions – the possibility to transfer and license technology from universities and research institutions to the corporate sphere. In an amendment to Law n°. 8.666/93, the act waives the need for tenders or bidding in the ICT technology transfer and licensing process, thus allowing a process known as *encomenda tecnológica*, a sort of technology outsourcing whereby a private company is hired as a government contractor for a certain R&D project or to provide a solution for a certain R&D issue, in accordance with national priorities for economic development. The Act codifies two schemes through which this process may be conducted: one includes an exclusivity clause giving the contracted company exclusive rights to explore the developed technology, and the other, which lacks exclusivity provisions, entitles government research institutions to freely exploit the results of the partnership. The former (exclusivity clause-based) scheme requires a public call for proposals to ensure the most advantageous partnership (Grando, 2005).

The Act also sets rules so that researchers may develop applied research and technological increments. The main mechanisms provided for this purpose are: an innovation encouragement grant and a temporary bonus payment to researchers in public service, both funded by the research activity's revenues; participation in up to 1/3 of revenues obtained by the company as a result of intellectual property use, as set forth in the Intellectual Property Act (Law 9.279/96); and unpaid leave for government-employed researchers who wish to start their own business, as long as it is a technology-based enterprise (Kruglianskas and Matias-Pereira, 2005; Grando, 2005). These new rules allow up to three years' leave, with the possibility of a three-year extension, for government researchers who wish to set up innovation-related startups.

The Innovation Act also authorizes the direct provision of government funding to a specific corporate project, with mandatory offsets and evaluation of results. In addition, the Act provides for state participation in special purpose entities and investment funds (Kruglianskas and Matias-Pereira, 2005). Lastly, one of the greatest merits of the Act is its definition of mechanisms for the provision of government subsidies and grants to private businesses – a longstanding demand of the corporate sector. The provision of government funding as a means of fostering corporate innovation is widely used in developed countries, in accordance with WTO rules.

According to a PITCE summary published in March 2007 by ABDI, the government released around R$ 209 million in funding to enact the provisions of the Innovation and Good Acts. The first call for proposals would provide a total of R$ 300 million in grants and subsidies, R$ 210 million of which would be assigned to designated priority areas, with the remaining R$ 90 million going to general PITCE themes. Despite a high demand in 2006 – 1.099 proposals were submitted for a total of R$ 1.9 billion requested –, proposals in priority areas were not sufficient to meet the investment goal. R$ 155 million remained and were reassigned to the second phase of the call for proposals, which funded general (non-priority) projects. The first phase of the call (priority projects) provided R$ 68.8 million in funding to microenterprises and small businesses, clearing the R$ 60 million minimum that had been proposed for SME funding.

The second call for proposals, providing R$ 150 million, received 85 proposals requesting a total of R$ 813 million. Thirty-one proposals, requesting R$ 362 million with a proposed offset R$ 182 million, qualified. Finally, the third call for proposals, which concluded in early 2008, provided R$ 60 million to companies wishing to hire graduate-level researchers for in-house technological innovation activities. A total of 144 grants were approved during ten rounds of selection.

From the government's standpoint, according to our interviewee, the advances provided by the Innovation Act are clear when one compares two MCT/FINEP calls for proposals (01/2006 and

01/2007), which prioritize funding of innovation projects in Brazilian companies, and the influx of proposals in each year. In 2007, the number of proposals received amounted to R$ 4.9 billion, that is, a 233.36% increase compared to the previous year. Microenterprises and small businesses accounted for 59% of approved projects. Another important data regards the increase of projects in the Northeast, North and Central-West regions, which rose to 30%, having grown 18% over the past year. It is important to emphasize, though, that even with an increase in funding provided in 2007, project acceptance has slumped significantly. Resources allocated to projects amounted to R$ 313.7 million, i.e., 69.71% of resources made available as officially published by the government. As the demand for projects increased significantly, we believe one of the issues may be the quality of proposed projects and the quality of the analysis process itself, which may be explained partly by the short time available for project assessment and pertly by the insufficiency of technical commissions appointed to make such assessments. The results of subsidies and grants provided are only one of countless items provided for in the Innovation Act, though. Since the Act is a recent advancement, public agencies responsible for following its results still do not have information on the number of strategic partnerships established or the amount of services provided by scientific and technological institutions (ICTs).

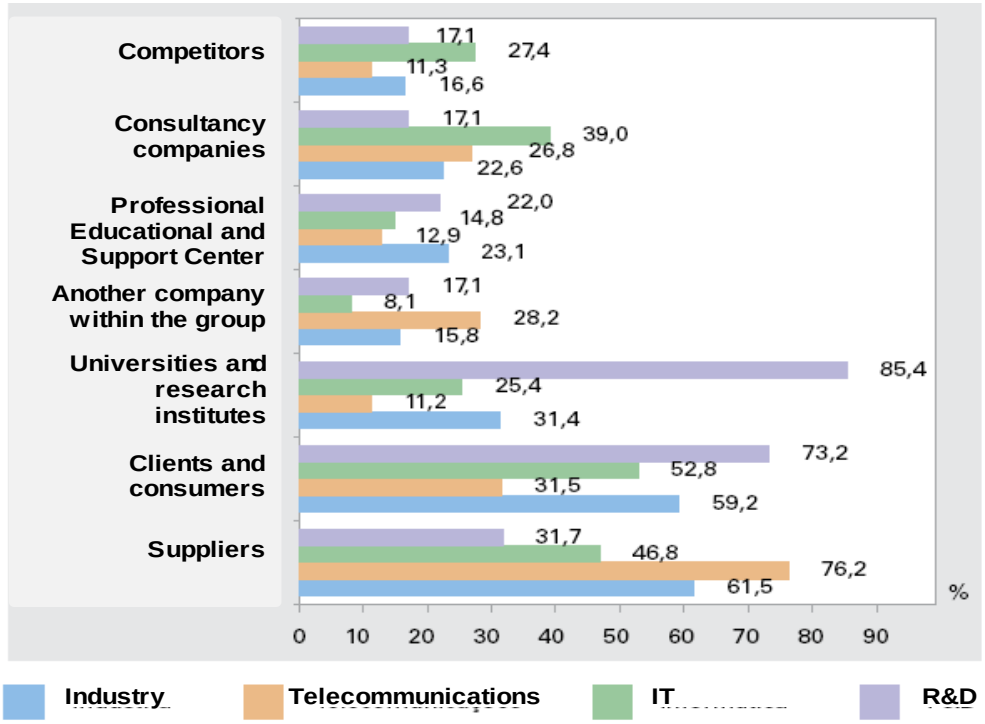
From the standpoint of academia, according to the representative interviewed, one of the main benefits afforded by the Innovation Act to the university-corporation relationship was the establishment of clearer rules for result appropriation. In this context, scientific and technological startups benefited most from the Act's provisions. The new regulatory framework encouraged and made possible the establishment of partnerships between research universities and private businesses, the sharing of lab facilities, and additional compensation for researchers, as well as regulating revenue participation and technology transfer in the public sphere.

One negative point is the fact that, when a proposed academic-corporate partnership involves an exclusivity clause, publication of a call for proposals is required by law in order to ascertain which companies will be interested in the partnership and which offers the best proposal from the university's standpoint. If, on the one hand, transparency is a core principle of public administration, the publication of calls for proposals has the potential to make university-corporation partnerships undesirable in that public calls will invariably disclose the corporate technology responsible for initiating the partnership, making it known to competitors. The thought of companies competing for university-produced technology is also highly unusual, since most technologies resulting from scholarly research are usually geared at the production of further basic research and are rarely mature enough for corporate implementation. There is no corporate culture of competing for scholarly research.

In fact, information sources are considered a useful indicator for understanding innovative behavior, since at the core of any innovation project is an idea, which may have come from within the company or from an external source. Greater interaction between businesses and the other players in the national innovation system is observed in survey results on innovation projects established in partnership with other companies or institutions. Results of the 2003 PINTEC (IBGE, 2005), conducted before the Innovation Act came into force, showed a relative growth of 16% in the importance of universities and research institutes as partners in corporate relationships. The results of the 2005 PINTEC were presented in a different manner (IBGE, 2007), but here they were broken down by sector (Graph 4). These results show that the importance of scientific and technological institutions as partners is greater for R&D firms, followed by transforming industrial, IT, and telecommunications companies. Unfortunately, this change in the presentation of results made it impossible to compare the overall progression of indicators.

The Innovation Act is a landmark in the conception of a new national reality. The possibility of a transparent and proactive relationship between government, academia, and the corporate sphere implies unparalleled development and sophistication in public administration and its management instruments. The Act boldly broke away from public service paradigms concerning the capability and competence to innovate, particularly by giving government researchers the possibility to start their own technology-related businesses on the side. The effectiveness of the Innovation Act must be subject to permanent analysis and follow-up, especially concerning its provisions that delegate funding procurement procedures to scientific and technological institutions themselves (FILHO, 2005).

Graph 4: ***Importance of partners in cooperative relationships, broken down by select activities in the transforming industry and selective sectors in Brazil, 2003–2005***



Source: PINTEC 2005 (IBGE, 2007).

According to a study by Arruda *et al*. (2006), one must underscore that the Innovation Act cemented the strategic nature of innovation to the country's growth and explicitly provided for the direct provision of government funding to private enterprise, although such instruments were already employed in government subsidizing of R&D activity. Furthermore, the Act set certain ground principles concerning title rights to the results of research partnerships, private offsets to funding projects that do not provide for returns to the government, transparency in the application of public funds, and the possibility to outsource technology development.

Nevertheless, several culturan and bureaucratic barriers remain to be broken if the Act is to produce truly effective results. All involved parties must believe that partnerships and interactions

between research institutions and private enterprise are both possible and beneficial. Campaigns directed at advertising and publicizing novel legal instruments have long been conducted by developed nations, such as Canada. According to Kruglianskas and Matias-Pereira (2005:15), "One can see that instruments are being made available, but greater involvement and commitment from involved parties is still necessary".[11] Knowledge of current legislation and the possibility of good results will lead to systematic, continuous cooperation, making innovation a tradition within Brazilian businesses. Indeed, the Act has already increased awareness of the need for private-public partnerships in the National Science, Technology and Innovation System by imposing the creation of NITs (*Núcleos de Inovação Tecnológica*, Technological Innovation Centers). These areas established within universities have become the center of the academia–private enterprise interface.

The Ministry of Science and Technology has followed the evolution of Innovation Act enforcement through information provided by scientific and technological institutions. In 2006, 54 Technological Innovation Centers were in the process of being implemented, up 284.21% from 19 in 2005. Royalties obtained from technology transfer or licensing rose from R$810 thousand in 2007 to R$4.53 million in 2008 – a 559.25% increase in a single year. Furthermore, 830 patent protection requests were filed in Brazil and 83 abroad (132 and 10 of which were granted respectively). These data therefore show that the Innovation Act has indeed improved cooperation between agents in the national innovation system. A Follow-Up Committee has been set up by the MCT, the Ministry of Development, Industry and Foreign Trade, and the Ministry of Education to observe application of the Act's provisions and suggest measures to contribute to its enforcement.

Outside of the country's South and Southeast regions, however, NIT implementation is still being structured; universities in these two regions already implemented such areas before the Innovation Act came into force. The country's current favorable economic outlook is conducive to concrete partnerships between universities and private enterprise. It is therefore expected that the establishment of such partnerships will be intensified after this initial education and maturity-building stage. On the other hand, there is no deadline for the implementation of NITs in universities; it depends on management-heavy structuring efforts, and mechanisms to accomplish it are still precarious in most higher learning institutions. As the Act is very recent, the impact of its results on innovation is still difficult to measure. Institutions are noticeably starting to improve their awareness of and openness to its provisions.

3.2. Good Act, Chapter III (Law 11.196/2005)

Law 11.196/05 revoked tax incentives provided for in Law nº. 8.661/93. However, projects approved before 31 December 2005 remained subject to the latter, with the possibility of their being ported to the new system. Indeed, an MCT report shows a large number of project transition requests filed in 2006 to place projects under the provisions of Law 11.196/05. This process is expected to continue, and most companies whose PDTIs or PDTAs have been approved are expected to transition to the new system.

In one of its main advances, the Good Act revoked the requirement for submission of Programs for the Development of Industrial Technology (PDTIs) or Programs for the Development of Agricultural Technology (PDTAs) before companies could be eligible for certain benefits; tax

[11] "Observa-se que os instrumentos estão sendo disponibilizados, mas é preciso um maior envolvimento e compromisso por parte dos atores envolvidos no assunto" (Kruglianskas and Matias-Pereira, 2005:15).

deductions are now automatic, as long as companies choose to use them and comply with certain record-keeping requirements (Moreira and Queiroz, 2007). Technological development and innovation expenditures, as well as benefits received, must be disclosed by companies by 31 July of the year following benefit use, as set forth in Decree nº. 5.798/06 (Brazil, 2007).

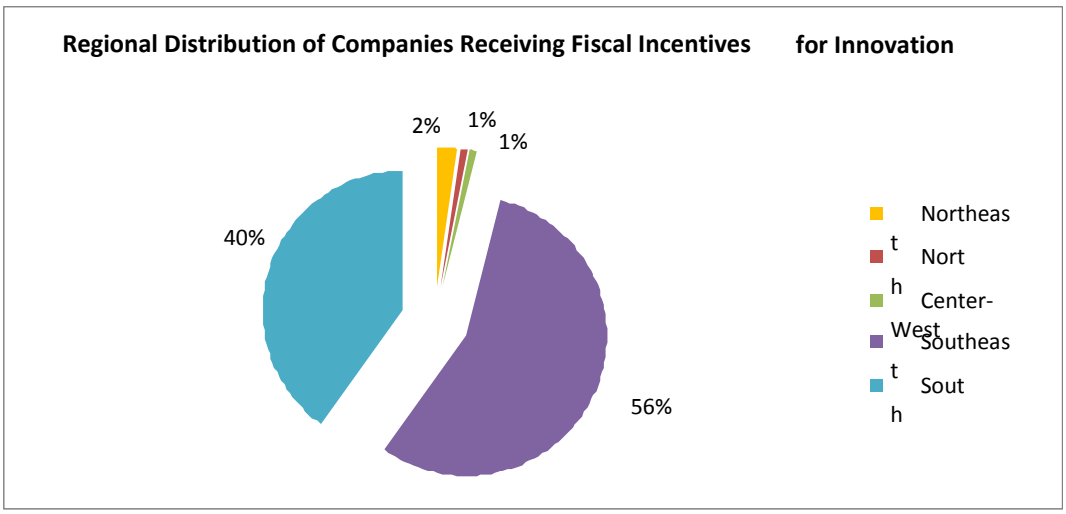
The main incentive provided by the Act is a net profit deduction, for actual profit and CSLL calculation purposes, of 60% of taxable R&D spending (or up to 80% depending on the number of researchers employed). It may also provide a 20% deduction on the expenses of developing any innovation that is later patented. Considering that R&D spending is usually deductible as operating expenses anyway, the Act's provisions may make companies eligible for tax deductions equal to twice their R&D expenditure.

ANPEI (2006) believes this incentive will be the most important in terms of providing cost reductions for companies operating under the actual profit taxation scheme. These companies may be eligible for 20% to 34% rebates on taxable R&D expenditures when compared to non–innovation-related expenses. Unfortunately, very few companies (less than 8% of all businesses) choose the actual profit scheme, and most that do are often large corporations; this incentive will therefore have no significant impact on the status quo of technological competitiveness for most Brazilian manufacturers. Another grave limitation of this incentive is the fact that it can only be used in the year for which R&D spending is calculated. If an eligible company has no real profit in that particular year or if its profits are insufficient for deducting all R&D expenses, the then-nondeductible portion of expenses cannot be deducted from any tax in that year or any other. Furthermore, the 20% extra deduction on technologies leading to patents is only valid once the patent is issued (ANPEI, 2006).

ANPEI (2006) states that grants meant to subsidize hiring of graduate-level researchers should gradually increase the proportion of such highly skilled workers in major companies, and will also provide companies that already employ graduate-level researchers in an R&D capacity with immediate cost reductions. In small and medium enterprises, this impact will likely be small, except in SMEs dealing with intensive, state-of-the-art technology, since these businesses need highly skilled and specialized personnel to handle their projects.

From the government's point of view, according to our interviewee, the Good Act has come with several important advancements, such as Law nº 11.487 of 15 June 2007 (known as the "MEC Law"), which amends the Good Act with Article 19a, providing a distinct innovation incentive scheme for science and technology institutions (ICTs) funded by private enterprise; these companies are then free to choose the original Good Act incentive scheme or that codified in Article 19a as desired. The MEC Law provides for tax deductions varying from no less than half and no more than two and a half times the value of funding provided, depending on the industrial and intellectual property rights resulting from the project. Companies that choose to receive these benefits must submit their projects to a tripartite commission composed of representatives from the Ministry of Education and Culture, the Ministry of Science and Technology, and the Ministry of Development, Industry and Foreign Trade.

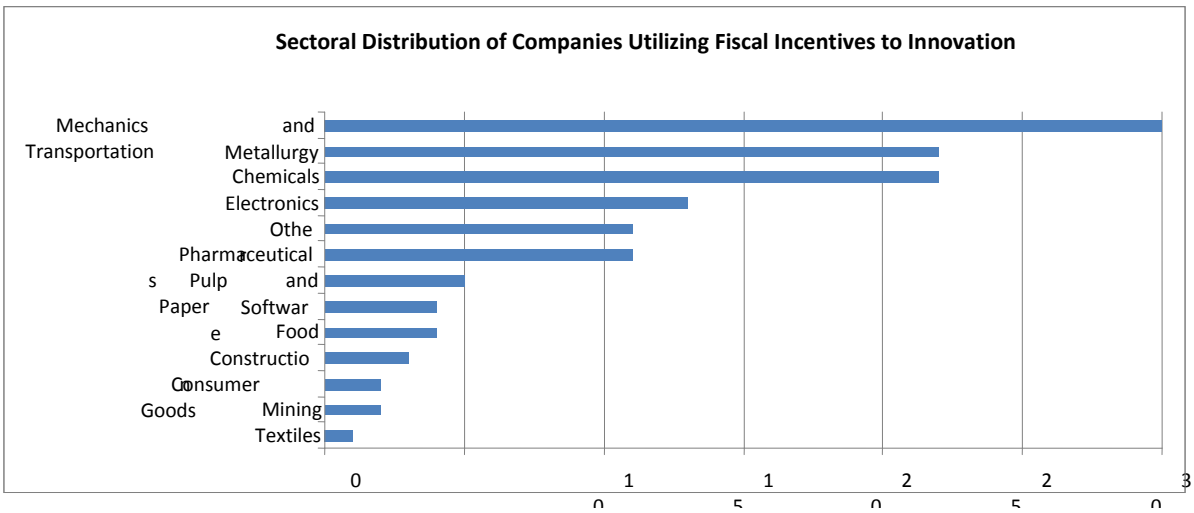
Graph 5: ***Regional distribution of companies receiving fiscal incentives in 2006***



Source: MCT (2007).

In 2005, while Law 8661/93 was still in effect, only 35 companies made use of tax benefits, for a total R$ 214.9 million in R&D investment. In 2006, after the Good Act came into effect, 130 companies in various sectors (a 360% increase), representing approximately 2% of companies operating under the "actual profit" taxation scheme (those that are eligible to receive the Act's benefits.) made use of tax incentives, and invested R$ 2 billion in R&D (Graphs 5 and 6).

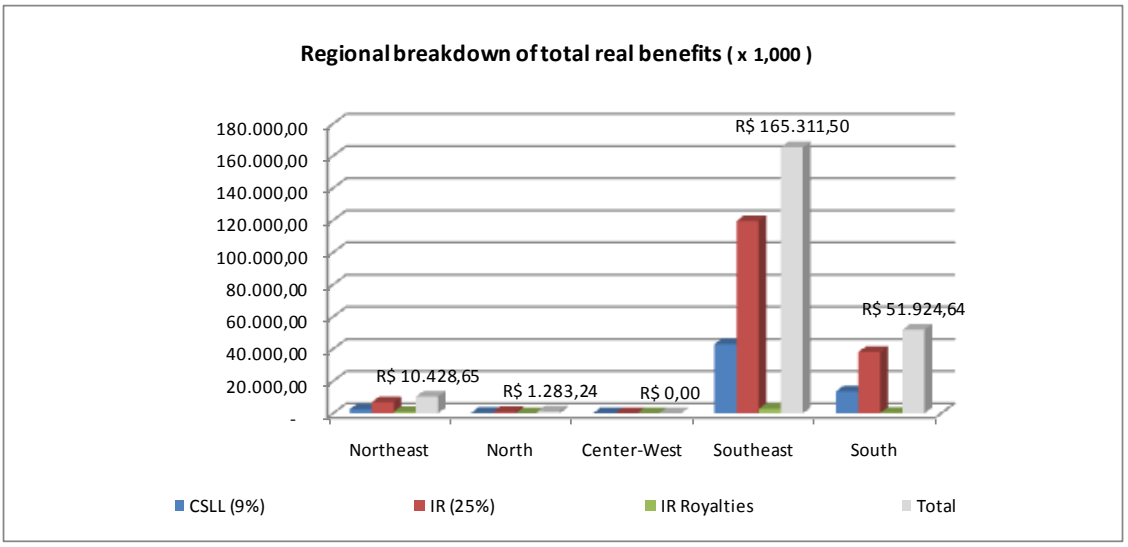
Graph 6: ***Sectors utilizing fiscal incentives in 2006***



Source: MCT (2007).

Around R$ 229 million in benefits were provided in 2006. The Southeast region received the most benefits, mostly because it accounted for 81% of total investments in technological innovation in 2006 (Graph 7).

Graph 7: ***Regional breakdown of total real benefits (2006)***



Source: MCT (2007)

Approval of the Good Act was meant to make the Brazilian economy a less inhospitable environment and minimize the effects of heavy taxation, *custo Brasil* (the notorious cost of doing business in the country), and an unfavorable currency exchange regarding to USD, among other obstacles.. Despite this significant increase, the Act's provisions and benefits are still largely unknown, but it is possible to say that advancements are still not enough and not backed by sufficiently adequate institutionality to overcome the uncertainties inherent to innovative activity. There is a consensus among innovation scholars that judicial uncertainty undermines building the trust of private investors in innovative activity and its expansion within a certain country. One example of judicial uncertainty in Brazil is the variety of ways in which the Federal Revenue Service may interpret recently implemented tax benefits. The very concept of innovation still bears elaboration and clarification (CGEE, 2006). Furthermore, recent regulatory advancements still do not adequately make up for an adverse macroeconomic environment that features a 38% tax burden (FIESP, 2006).

In the 2003 PINTEC (IBGE, 2005), only 0.7% of companies were found to make use of R&D tax incentives, which corresponds to roughly five thousand businesses. Relatively speaking, large corporations are the foremost beneficiaries of government programs. The results of the 2005 PINTEC (IBGE, 2007) confirmed this reality, showing that companies with over 500 employees (40.9% of businesses in the manufacturing sector, 16.7% of telecom companies, 25.1% of IT businesses, and 100% of those involved in R&D) benefit most from government programs. Machinery and equipment financing programs were those most widely used by innovative companies, and those provided for in R&D and technological innovation legislation were the least used.

As mentioned above, a change in the manner in which PINTEC results were presented in 2005 (IBGE, 2007) made it impossible to compare totals; results could only be compared between sectors. Bearing that in mind, the government program most widely used by industries was found to be innovation funding, including funds for purchasing machinery and equipment. Eleven percent of innovative small businesses made use of such funding, as did 15.9% of medium-sized businesses and 29.3% of large industries. On the other hand, only 0.7% of innovative industries made use of tax incentives meant to foster R&D.

In October 2005, the State of São Paulo Industry Federation (FIESP), through its Department of Competitiveness and Technology (DECOMTEC), conducted a survey of businesses in the manufacturing sector in order to assess their true innovation needs. Among other information, the survey revealed that 90% of respondent companies knew little about innovation support agencies and mechanisms, and 64% did not have sufficient training in the use of existing incentives meant to foster innovation.

From the companies' point of view, according to interviewees, the Good Act is far too sophisticated to be used by companies that would actually benefit from its provisions. Even simpler incentives such as research grants are underused by companies due to a sheer lack of knowledge of their availability. The FIESP survey showed that even a few large corporations, as well as many medium-sized businesses, were unfamiliar with incentives codified in the Good Act. Not many companies made sense of the legislation and implemented internal efforts to know it and use its provisions. The few who did created specialized internal departments to address fiscal and legal issues (that is, they employed the services of accountants and legal counsel), initially sought the assistance of external consultants to structure these departments, and set up separate accounts for funding agency and tax auditing purposes. The weight of bureaucracy on using the law to one's advantage is clearly known and feared by companies.

4. CONCLUSIONS AND RECOMMENDATIONS

Our analysis of government milestones in regulatory framework improvement during the past two administrations shows relevant advancements in the regulation and funding of science and technology in Brazil. The country has taken firm steps towards fostering innovation since 1999; it has been following several R&D-encouraging practices espoused by OECD member states. Nonetheless, Brazil clearly operates at a different pace and with inferior resources than those available to OECD countries. The main advancements brought about by a shift in government have concerned the country's view of the private sector as a source of innovation. The government has let companies know they need to incorporate innovation into every step of their production processes. It has also sent a clear message that the Brazilian economy will be opened wider and wider, so to speak, and that protectionist measures restricting access to certain classes of products and services as a means of fostering domestic research are a thing of the past. These improvements notwithstanding, further actions must be intensified if Brazil is to improve its position in international rankings and leave the sidelines of technological innovation.

Our analysis of the **Innovation Act** allows us to conclude that significant advancements have been made with the implementation of explicit, formal instruments for interaction between universities and the corporate sphere. Before the Act, this relationship lingered in informality,

undermining the possibility of long-term partnerships. Although instruments regulating the academia–private enterprise interaction are nothing new in other countries, the Innovation Act cemented the importance of technological innovation as a tool for the growth of Brazil. The academia–private enterprise interaction process has become more transparent and organized, although it is still not easy to understand and put into practice.

By enacting the Innovation Act, the Brazilian government has sowed the seeds of a new corporate outlook on partnering with research institutions and developing technology. Major results may be observed in calls for proposals held for the assignment of government funding. Corporate participation has increased, and the government has forwarded significant amounts of funding to foster in-company technological innovation. Nevertheless, the number of companies taking part in these calls for proposals dwarfs in comparison to the vast number of businesses operating in Brazil; this issue is compounded by the fact that calls for proposals are not widely published and that the deadline for project submission is usually quite short. Most companies that are ultimately able to obtain funding are those that already had organized, documented in-house initiatives in the first place and were just waiting for a chance at development.

According to universities, companies still find it difficult to operationalize benefits provided by legislation, and the paradigm that universities and businesses operate in different worlds still holds considerable sway. If, on the one hand, recent legislation has created a more transparent and organized environment in which the academia–corporate sphere relationship may take place, the requirement that calls for proposals be made public if a proposed partnership includes an exclusivity clause hampers this interaction. Companies do not want competitors to know they are interested in certain research technologies, but they are simultaneously wary of investing on research if they have no guarantee of exclusivity in exploring its future benefits. The gap between these two universes must therefore be bridged, and each party needs to build a greater understanding of the other. Corporate culture is far more pragmatic than that of scholarly institutions; university–private enterprise interaction mechanisms must therefore become more dynamic and tax benefits must be extended to all businesses regardless of size.

Analysis of the **Good Act** showed advancements, but the number of companies reaping its benefits is still very small. Furthermore, most companies are unable to understand the Act and apply its provisions, and depend on external consultancy services to implement them. According to the federal government, the Ministry of Science and Technology has detected that interested companies have trouble using the Good Act to their advantage and has made some efforts to improve awareness and understanding of its provisions. To the government, transition to this new legal scenario and its automaticity are already evidence of a significant improvement in the Brazilian regulatory framework. Current instruments provide leverage for corporate innovation and, consequently, greater competitiveness.

For companies, greater integration between all government bodies involved, including those tasked with inspecting and auditing use of incentives, is still necessary. Judicial insecurity is still a major concern, and government agencies must display signs of stability and continuity in the innovation fostering process. Benefits and incentives are still not widely publicized, and companies depend on specialized external consultancy services to use the provisions of new legislation to their advantage. Innovation fostering instruments are mostly scattered and disconnected, which leaves few companies able to actually use them.

It is important to raise awareness of the fact that most innovation occurs within businesses and not in learning or research institutions, which leads to internal R&D investment, and that innovation

is not limited to large or multinational organizations, but may be used by all, even small businesses and microenterprises with no dedicated R&D function or dedicated resources. The groundwork for fostering innovation in Brazil has been laid, and the three players in the national innovation system – government, academia, and the corporate sphere – must now, so to speak, sit down and talk things through. In order to achieve this integration, we suggest that close attention be paid to the number of companies establishing partnerships with research universities and the number of companies that choose to use the provisions of recently enacted innovation fostering legislation. Brazil is still immature when it comes to implementing this sort of legislation as compared to Canada, the U.S., South Korea, and a few European nations. In Brazil, emphasis is still mostly placed on science and technology for its own sake, and not on its actual translation into innovation that will meet the economic and social demands of the community.

The improvements found in the course of our study notwithstanding, many challenges still need to be overcome, and most certainly beyond the "acceptable minimum" level, in order for this transformation to occur. These challenges include:

From the government standpoint:

- governability – that is, a minimum capacity to manage the country effectively as a true nation headed for full development;
- greater awareness of technological issues from the Executive, Congress, and society as a whole;
- continued economic stability and liberalization of the Brazilian economy;
- establishment of public policies – for industry, technology, internationalization, and export promotion – that translate quickly from legislation to reality, and are sustainable for a reasonable amount of time so they can at least be put to effective use and properly assessed;
- definition of regional, sector, and dimensional priorities, with particular attention afforded to small businesses;
- provision of adequate financial conditions (generous access to capital, including risk capital, under advantageous conditions);
- maintenance of fiscal mechanisms (provision of attractive, bureaucracy-free tax incentives such as those recently implemented, although they have not yet achieved widespread use);

From the academic standpoint:

- university-level qualification adequate to the demands of Brazilian businesses, built upon a reality of incremental innovation and not necessarily on revolutionary technology;
- extensive basic and professional training, based on fostering vocational education and educating for entrepreneurship;

- a change in corporate culture, making it easier for universities to interact and establish partnerships with companies in all sectors of industry, and particularly with small businesses;

From the corporate standpoint:

- a change in corporate attitude through internalization of the technology variable as providing a competitive advantage, particularly to encourage exporting in the short-term and to make progressive internationalization and globalization possible in the future;
- insertion of highly skilled (graduate-level) researchers into the manufacturing sector, where they will help to create, maintain, and expand technological capacity compatible with the business world's competitiveness requirements.

Although corporate competitiveness will be increasingly tied to innovative capacity in the new millennium, many barriers still remain to be surmounted in the interaction between government, academia, and private enterprise if technological innovation is to take off once and for all in Brazil. Scholars and businesspeople alike frequently and insistently wonder how a country featuring the tenth most powerful economy in the world, the largest and most diverse industry in Latin America, a respectable sci-tech infrastructure, and a large number of well-trained scientists and engineers is unable to become a powerhouse of technology. If this question is to be answered, Brazil's future in terms of technology and innovation must be tied to a corporate search for international competencies, through improved efficiency, higher quality, more flexibility, and greater innovativeness. Regulatory framework advancements are not only necessary but also utterly essential for such achievements.

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